



ASSESSMENT OF DRILLING & WORKOVER RIG STORM SEA FASTENINGS ON OFFSHORE FLOATING PLATFORMS DURING HURRICANE IVAN - PHASE 1 (MMS 551)



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E.G. Ward (OTRC) and J.M. Gebara (Technip)

INTRODUCTION: Drilling and workover rigs on Floating Production Systems (FPSs) are typically tied down or fastened to the decks of offshore structures by large diameter bolts, weldments, braces, or other means, which we will term here generally as “storm sea fastenings” to prevent movement during hurricanes. During Hurricane Ivan, a number of drilling or workover rigs shifted. These movements are being assessed along with the current design philosophy and criteria for storm sea fastenings, rig and storm sea fastening installation practices, and onboard storm operational practices to ready FPSs for a hurricane. Results will provide information that can be used to assess any needs to revise tie-down criteria or practices to avoid future damage.

Phase 1 is focusing on

- Collecting information and data on Floating Production Systems (FPSs) in the path of hurricane Ivan or Hurricane Lili that had platform drilling or workover rigs.
- Conducting a stakeholder's Workshop to discuss processes used to design and implement tie-downs.
- Completing an example case study comparing the actual behavior of a rig that moved on an FPS during Hurricane Ivan with the environmental load effects predicted by current practice and API guidelines for a rig tie-down design
- Completing a Phase 1 Report that includes a detailed plan for Phase 2

Phase 2 is envisioned as a JIP that will focus on

- Completing case studies of failures and successes of rig tie-down systems during hurricane Ivan
- Evaluate tie-down design options to prevent observed movements during storms
- Review Practices for exchanging Rig/Floating System Information needed for tie-Down design
- Document findings in a Final Report and presenting results to MMS and industry

PROGRESS: Figure 1 shows the FPSs exposed to Hurricane Ivan. Phase 1 will include data gathering, field visits of selected platforms, and analysis of one of the four failures. Table 1 below indicates the specific Floating Production Systems selected for study during Phase 1. These include the FPSs with rig movements and others that were selected for field visits.

Questionnaire - A questionnaire (Attachment 1) was developed and is being used to gather data and as a basis for discussions with operators. Data has been gathered on those FPSs indicated with a check mark. The information is being documented and will be compiled when completed.

Field Trip - A field trip to visit to Shell's Brutus TLP, Murphy's Front Runner spar, and BP's Holstein and Mad Dog spars was arranged by Tommy Laurendine, MMS GOM Region. MMS provided a helicopter and an Inspector to accompany Joe Gebara and Skip Ward on the August 26.

Front Runner - Medusa had no rig on board at the time, so Front Runner was visited. Front Runner had a rig on board with the same bolted sea fastener system that had been devised for Murphy's spars after Ivan. The system uses high strength bolts and clamps. The bolts are torque to a specified torque. See Figures 2.

Brutus - Brutus was visited because it was convenient and had the same bolted sea fastening system that had been devised for all Shell TLPs following Ivan. The system uses high strength

bolts and clamps. The bolts utilize torque indicating washers to achieve a specific torque. At the time of our visit, the torque washers had not been delivered, but the high strength bolts and clamps were installed and torqued. See Figures 3.

Holstein - Holstein was visited because it was convenient and represents a different type of sea fastening system. The rig skidding system is a hydraulically driven rack and pinion system. The sea fastening system is a set of locking dogs that are force into the cogs by locking screws. See Figures 4.

Mad Dog - Mad Dog was visited because it was convenient and represents yet another different type of sea fastening system. The rig skidding system is a hydraulically driven clamping and pulling system. The sea fastening system locks the clamps on the skid beams with tapered pins. See Figures 5.

During this field visit we were also able to witness hurricane preparations in progress since Hurricane Katrina had entered the Gulf and was forecast to move near the FPSs we visited.

Current Activities - Current activities are focused completing data gathering and compiling and interpreting the results. We anticipate this effort will take longer than anticipated due to operator activities related to recovery from Hurricane Katrina. These sea fastening systems will be documented more thoroughly than the brief summaries presented here.

Data gathering via the questionnaire and individual contacts has worked well, and we will evaluate the need and scope for the Workshop we had originally planned for this activity. Information will be gathered on operator estimates of design holding capacity and loads for these and compared to estimates that we will make.

Table 1 FPS's in Ivan Being Considered in Phase 1 Study

Floating Production System		Operator	Selected for study in Phase 1?	Reason/Remarks	Tie Down System	Assessment		Analyze
						Gather Data	Field Visit	
TLPs	Ram Powell	Shell	Yes	Rig movement during Ivan.	Bolted	✓		P2?
	Mars	Shell	No	No rig movement during Ivan. East of storm track				
	Brutus	Shell	Yes	No rig movement during Ivan. East of storm track. Same tie down as Ram Powell.	Bolted	✓	✓	
	Ursa	Shell	No	No rig movement during Ivan. East of storm track				
	Marlin	BP	No	No rig not onboard during Ivan				
	Mattehorn	Total	No	No rig movement during Ivan. possible analysis case in Phase 2?				
Spars	Medusa	Murphy	Yes	Rig movement during Ivan. No rig currently onboard	Bolted	✓		Phase 1?
	Devils Tower	Dominion	Yes	Rig movement during Ivan				Phase 2?
	Front Runner	Murphy	Yes	No rig movement during Ivan. East of storm track. Same sea fastening as Medusa.	Bolted	✓	✓	
	Horn Mountain	BP	Yes	Rig movement during Ivan.				Phase 2?
	Mad Dog	BP	Yes	No rig movement during Ivan. Unique sea fastening system. Far east of storm track.	Hydraulic clamps that are integral part of rig hydraulic skidding system	✓	✓	No
	Holstein	BP	Yes	No rig movement during Ivan. Unique sea fastening system. Far east of storm track	Locking cogs that are integral part of rack & pinion rig skidding system	✓	✓	No
	Genesis	Chevron	No	No rig movement during Ivan. Far east of storm track				
	Neptune	Kerr McGee	No	No rig on board during Ivan.				

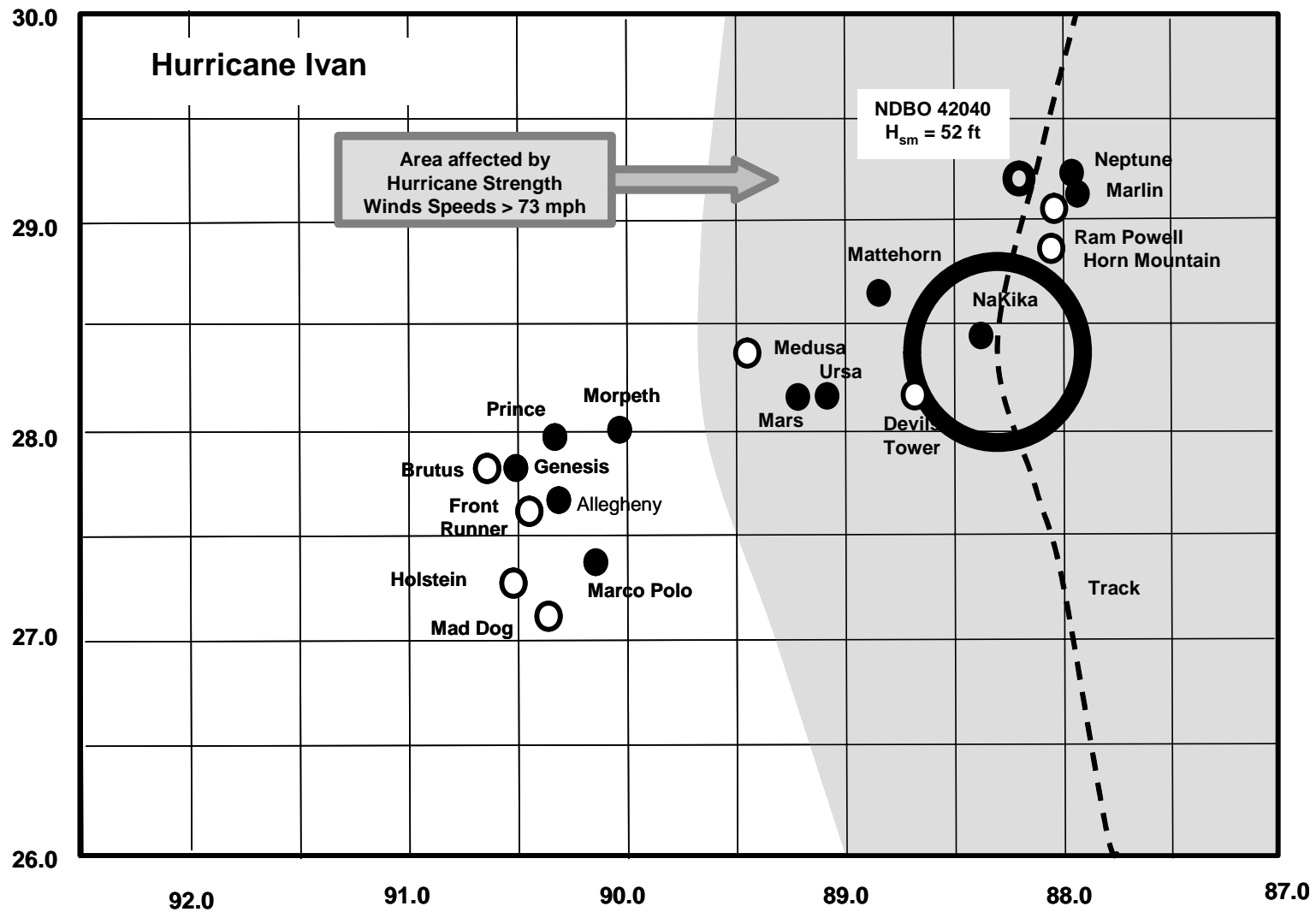


Figure 1 - FPSs Exposed to Hurricane Ivan

Figures 2 - Front Runner



Skid Beam to Deck with Bolted Stop



Skid Beam to Deck with Weldment Stop

Figure 3 - Brutus



Drill Floor to Skid Beam



Skid Beam to Deck

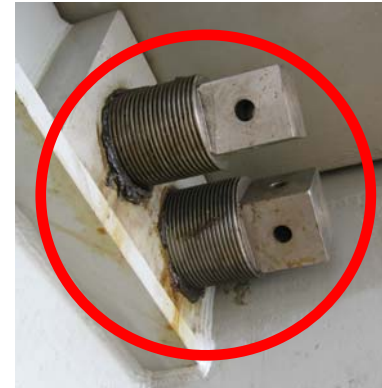


Torqued Bolt



Rack & pinion system to move skid base across deck

Figures 4 - Holstein



Locking bolts to secure toothed dog into rack

Figures 5 - Mad Dog



Skid base on deck skid beam - beam on bolted runner guide & hydraulic clamp



Hydraulic clamp with tapered pin